CLAIMS

We claim:

1. A material comprising
   aerogel particles and
   a polytetrafluoroethylene (PTFE) binder
   wherein the material has a thermal conductivity of less than or equal to 25 mW/m K at atmospheric conditions.

2. The material of claim 1 wherein the material has a thermal conductivity of less than or equal to about 20 mW/m K at atmospheric conditions.

3. The material of claim 1 wherein the material has a thermal conductivity of less than or equal to about 17 mW/m K at atmospheric conditions.

4. The material of claim 1 wherein the aerogel has an average pore size less than or equal to about 100 nm.

5. The material of claim 1 wherein the aerogel is present in an amount of greater than or equal to about 40 % wt.

6. The material of claim 1 wherein the aerogel is present in an amount of greater than or equal to about 60 % wt.

7. The material of claim 1 wherein the aerogel is present in an amount of greater than or equal to about 80 % wt.

8. The material of claim 1 wherein the aerogel is formed from an inorganic oxide.

9. The material of claim 1 where the aerogel is silica aerogel.

10. The material of claim 1 wherein the material is formed from polytetrafluoroethylene (PTFE) particles having a particle size of about 50 nm to about 600 μm.

11. The material of claim 1 further comprising at least one additional component selected from opacifiers, dies, fibers and polymers.

12. The material of claim 11 wherein the opacifier is carbon black, titanium dioxide, iron oxides, silicon carbide, molybdenum silicide, manganese oxide or polydialkylsiloxanes, wherein the alkyl groups contain 1 to 4 carbon atoms.

13. The material of claim 1 wherein the material is a powder.

14. The material of claim 1 wherein the material is formable or moldable.

15. The material of claim 1 wherein the material is a putty.

16. The material of claim 1 wherein the material is between two walls of a double walled container.

17. The material of claim 1 wherein the material is a tape.

18. A structure comprising
two layers and
a material bonded between the two layers,
wherein the material comprises aerogel particles and a polytetrafluoroethylene (PTFE) binder.

19. The structure of claim 18 wherein at least one of the layers is impermeable to liquids.

20. The structure of claim 18 wherein at least one of the layers is impermeable to gases.

21. The structure of claim 19, wherein at least one of layers is selected from metal foils and metallized polymer films.

22. The structure of claim 20, wherein at least one of layers is selected from metal foils and metallized polymer films.

23. The structure of claim 19, wherein at least one of the layers is aluminum or copper.

24. The structure of claim 20, wherein at least one of the layers is aluminum or copper.

25. The structure of claim 19, wherein the impermeable layers are comprised of expanded polytetrafluoroethylene (ePTFE).

26. The structure of claim 18 wherein at least one of the layers is permeable to gases.

27. The structure of claim 26, wherein at least one of the permeable layers is permeable to water vapor.

28. The structure of claim 27, wherein at least one of the permeable layers comprises expanded polytetrafluorethylene (ePTFE).

29. The structure of claim 26, wherein at least one of the permeable layers comprises continuous polymer film.

30. The structure of claim 29, wherein at least one of the permeable layers comprises polyurethane.

31. The structure of claim 18, wherein at least one of the layers is elastomeric.

32. The structure of claim 31, wherein at least one of the layers is a thermoplastic elastomer.

33. The structure of claim 32, wherein at least one of the layers comprises polyurethane, polyesters, polyamides and copolymers thereof.

34. The structure of claim 18 wherein the insulating material has a thermal conductivity of less than or equal to about 25 mW/m K at atmospheric conditions.

35. The structure of claim 18 wherein the insulating material has a thermal conductivity of less than or equal to about 20 mW/m K at atmospheric conditions.

36. The structure of claim 18 wherein the material has a thermal conductivity of less than or equal to about 17 mW/m K at atmospheric conditions.

37. The structure of claim 18 wherein the aerogel is formed from an inorganic oxide.

38. The structure of claim 37 wherein the aerogel is silica aerogel.

39. The structure of claim 18 wherein the aerogel comprises greater than or equal to about 40 % wt of the material.

40. The structure of claim 18 wherein the material further comprises at least one additional component.

41. The structure of claim 18 wherein the material further comprises an opacifier.

42. The structure of claim 18 wherein the material is bonded between two layers with a non-adhesive bonding.

43. The structure of claim 18 wherein the material is bonded between two layers with an adhesive.

44. The structure of claim 18 wherein the structure is formed as a tape.

45. The structure of claim 18 wherein the structure may be flexed or wrapped without a substantial change in thermal conductivity.

46. The structure of claim 18 wherein the structure is wrapped around a pipe to form an insulated pipe.

47. The structure of claim 18 wherein the structure is an insert for use in apparel.

48. The structure of claim 18 wherein the structure is an insert for use in footwear.

49. The structure of claim 18 wherein the structure is an insert for use in gloves.

50. The structure of claim 18, wherein the structure has a thickness of greater than or equal to about 0.5 mm.

51. An article comprising
at least two surfaces and
an insulating material between at least two surfaces,
wherein the insulating material comprises aerogel particles and interconnected polytetrafluoroethylene (PTFE) fibrils, the insulating material having a thermal conductivity of less than or equal to 25 mW/m K at atmospheric conditions.

52. The insulating structure of claim 51, wherein the insulating material is a putty.

53. The insulated article of claim 51 wherein at least one surface is rigid.

54. The insulated article of claim 51 wherein at least one surface is flexible.

55. The insulating article of claim 51 wherein the surfaces are non-porous.

56. The insulated articles of claim 51 wherein the surfaces are two walls of a double-walled pipe.

57. The insulated article of claim 51, wherein the surfaces are two walls of a double-walled container.

58. A method of forming a structure comprising
providing two layers, and
providing an insulating material between the two layers, wherein the insulating material comprises aerogel particles and a polytetrafluoroethylene (PTFE) binder, and wherein the insulating

material has a thermal conductivity of less than or equal to 25 mW/ m K at atmospheric conditions.

59. The method of claim 58 further comprising the steps of sealing at least three sides of the structure, applying a vacuum to the structure, and sealing a fourth side of the structure to reduce the pressure to below atmospheric pressure.

60. The method of claim 58 wherein the structure is a tape.

61. A material comprising
aerogel particles and
interconnected polytetrafluoroethylene (PTFE) fibrils,
wherein the material has a thermal conductivity of less than or equal to 25 mW/m K at atmospheric conditions.

62. The material of claim 61 wherein the interconnected fibrils are interconnected to other polytetrafluoroethylene fibrils or particles.

63. The material of claim 62 wherein the aerogel particles are situated within or around the interconnected fibrils.

64. The material of claim 61 wherein the material has a thermal conductivity of less than or equal to about 20 mW/m K at atmospheric conditions.

65. The material of claim 61 wherein the material has a thermal conductivity of less than or equal to about 17 mW/m K at atmospheric conditions.

66. The material of claim 61 wherein the aerogel is present in an amount of greater than or equal to about 40 % wt.

67. The material of claim 61 wherein the aerogel is present in an amount of greater than or equal to about 60 % wt.

68. The material of claim 61 wherein the aerogel is present in an amount of greater than or equal to about 80 % wt.

69. The material of claim 61 where the aerogel is silica.

70. The material of claim 61 further comprising at least one additional component selected from opacifiers, dies, fibers and polymers.

71. The material of claim 61, wherein the material forms a core material between two layers to form a composite structure.

72. The structure of claim 71 wherein at least one of the layers is impermeable to liquids.

73. The structure of claim 71 wherein at least one of the layers is impermeable to gases.

74. The structure of claim 72, wherein at least one of layers is selected from metal foils and metallized polymer films.

75. The structure of claim 73, wherein at least one of layers is selected from metal foils and metallized polymer films.

76. The structure of claim 74, wherein at least one of the layers is aluminum or copper.

77. The structure of claim 75, wherein at least one of the layers is aluminum or copper.

78. The structure of claim 72, wherein the impermeable layers are comprised of expanded polytetrafluoroethylene (ePTFE).

79. The structure of claim 71 wherein at least one of the layers is permeable to gases.

80. The structure of claim 79, wherein at least one of the permeable layers is permeable to water vapor.

81. The structure of claim 80, wherein at least one of the permeable layers comprises expanded polytetrafluoroethylene (ePTFE).

82. The structure of claim 79, wherein at least one of the permeable layers comprises continuous polymer film.

83. The structure of claim 79, wherein at least one of the permeable layers comprises polyurethane.

84. The structure of claim 71, wherein at least one of the layers is elastomeric.

85. The structure of claim 84, wherein at least one of the layers is a thermoplastic elastomer.

86. The structure of claim 85, wherein at least one of the layers comprises polyurethane, polyesters, polyamides and copolymers thereof.

87. The material of claim 51, wherein the composite is under vacuum pressure between 0.001Pa and 100 000Pa.

88. A portable electronic device comprising
at least one heat generating component,
an enclosure, and
an insulating structure located between the heat generating component and the enclosure.

89. The device of claim 88 wherein the insulating structure has a thermal conductivity of less than or equal to 25 mW/m K at atmospheric conditions.

90. The device of claim 89 wherein the insulating structure comprises an insulating material comprising aerogel particles and a polytetrafluoroethylene (PTFE) binder.

91. The device of claim 90 wherein the insulating material is a composite further comprising two additional layers.

92. The device of claim 88 wherein the enclosure has a surface and at least portion of the surface is designed to be in direct contact with a user.

93. The device of claim 88 wherein the device is a computer.

94. The device of claim 88 wherein the device is a cellular phone.

95. The device of claim 91 wherein the two layers are expanded polytetrafluoroethylene (ePTFE).

96. A method comprising the steps of providing a portable electronic device having at least one heat generating component and an enclosure having a surface, and placing an insulating structure between the heat generating component and the enclosure, thereby preventing or delaying the transfer of heat generated from a heat generating component to at least a portion of the enclosure surface.

97. The method of claim 96 wherein the insulating structure comprises a material comprising aerogel particles and a polytetrafluoroethylene (PTFE) binder, the material having a thermal conductivity of less than or equal to 25 mW/m K at atmospheric conditions.

98. The method of claim 96 wherein at least part of the enclosure surface is designed to be in direct contact with a user.